TREATMENT OF COMPOUND FRACTURES.[1]

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IN no class of accidents is the influence of antiseptic treatment more apparent than in compound fractures. Before the antiseptic period the mortality in these accidents from septicemia, pyemia and erysipelas was simply frightful. No prognosis could be given in a single case, not even in a simple puncture of the skin. Bilroth gave in gunshot fractures a mortality of 60 per cent. for the femur, 24 per cent. for the leg below the knee.

But in civil hospitals the results were even worse. Volkmann lost 25 of 104 cases of compound fractures from gunshot wounds at Trantenau, viz.: 24 per cent ; but 26 of 64 compound fractures of the leg in the hospital in Halle in peace, viz.: 40 per cent., and yet a great many were simple punctures of the skin.

Of 885 cases of compound fractures of the leg below the knee collected from different sources 339 died, viz.: 38 per cent., while the mortality in war was but 24 per cent.

This was the general rule and not characteristic for one hospital. Baum, in Gottingen, had 38 per cent. mortality.

Bilroth in Zurich had 38.7 per cent. mortality;
Clinic in Breslau had 40.5 per cent. mortality;
Clinic in Halle had 40.6 per cent. mortality;
Clinic in Bonn had 41.8 per cent. mortality;
Luke in Berne had 38 per cent. mortality;

I am informed from credible sources that at the Buffalo General Hospital shortly before 1880 16 consecutive cases of compound fracture of the leg terminated fatally.

It is scarcely to be wondered at that with such general results Volkmann's paper on the treatment of complicated fractures in

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1877 occasioned the greatest astonishment. He reported 75 cases of which 8 were amputated secondarily, but all 75 recovered. Of these 75 cases, 43 had fracture of the leg below the knee, of which one was amputated. Volkmann's method was as follows:

The wound was dilated with the knife in every case so that a finger could be introduced and the fracture seen and felt. The wound was thereafter thoroughly disinfected with carbolic acid solution, all coagula being removed. All pockets under the skin were opened freely in order to drain them, and a number of incisions were made, particularly where the skin was torn loose from the fascia in order to remove the blood and introduce drains so that the skin might adhere again by first intention.

Badly crushed parts of muscles were occasionally removed. The fracture was thereafter disinfected, if necessary through a new incision. All loose splinters were removed while those attached to the periosteum were left in situ. Sharp bone-points were removed with bone scissors. After repeated irrigation a number of short drainage tubes were introduced vertically, the wounds sutured and an antiseptic bandage and lateral splints applied. The first dressing decided the fate of the patient.

The whole dressing was removed in all severe cases inside 25 or 48 hours in order to satisfy him that everything was all right, and thereafter regularly every second, fourth, or sixth day till no secretion appeared any more and till the blood coagula had been substituted by granulations. The drains were then removed and a permanent plaster of Paris bandage applied. The method was, although successful, quite laborious.

It is now fifteen years ago since Volkmann's paper appeared. It ought to have revolutionized the teachings of the treatment of compound fractures, and yet has it done so? We need only to take any one of the numerous text books on surgery in the English language and we will in almost all find the following recommendations: If a mere puncture is present seal it up with collodium or compound tincture of benzoin.

If suppurations occur incise and treat on general principles. If there is a large wound and lacerated edges, syringe it out with strong antiseptics, insert drainage tubes, apply antiseptic bandages and splints.

If the bone is comminuted remove loose splinters, saw off projecting edges, wire the fragments and treat on general principles. In severe compound fractures with extensive lacerations of soft tissues, ruptures of large arteries and nerves and opening of large joints, amputate.

For several years I have employed a uniform and more radical method in dealing with this class of accidents, and the results have been as encouraging as the method is logical. A compound fracture is simply a contused and lacerated wound, as little inclined to heal by first intention as any other contused and lacerated wound, not to mention that the wound is often, even in simple punctures, filled with dirt, the sharp ends of the bones having gone through the clothing and into the ground. I have rarely examined such a wound without finding foreign particles in it.

To seal such a wound with collodium is as unscientific as it is dangerous, even if it occasionally heals without any accident occurring.

I have therefore in every case of compound fracture for several years endeavored to change the contused and lacerated wound into a simple incised wound in which I confidently might expect healing by first intention.

On admittance to the Sister of Charity Hospital a patient with a compound fracture of the leg or any other place is invariably anesthetized, and the leg then as thoroughly disinfected as can be done with soap, brush, razor and corrosive sublimate. The wound, even if a simple puncture, is thereafter freely incised, an Esmarch's bandage having been previously applied. All crushed and lacerated or with blood suffused and suspicious looking tissues are thereafter thoroughly removed with curved scissors, and that whether they be parts of skin, subcutaneous tissue, fascia or muscle; I prefer to take away too much rather than to leave anything suspicious behind. Every pocket is opened along its whole length and treated in the same way. If deepseated pockets be found between the muscles, large openings are made in the most convenient spot in order to deal intelligently with them. Loose splinters are removed, and if the fracture is severe or comminuted the ends of the bones are forced out through the wounds, thoroughly cleaned and the blood clots removed between and behind them. Sharp points are removed with bone scissors, and in comminuted fractures the bone-ends occasionally sawed off transversely. I quite often have found loose splinters and even foreign particles behind the bone-ends.

The Esmarch's bandage is thereafter removed in order to find and ligate bleeding arteries, and then reapplied. The wound having been thoroughly disinfected with corrosive sublimate (1-2000) and the fractured bones having been brought into apposition and carefully held there by the principal assistant, the different wounds are closed with catgut sutures with the exception of about ½ inch in each wound, which is left open for drainage. A strict antiseptic bandage is thereafter applied, and this covered with a plaster of Paris bandage, taking in both the knee and the foot. The Esmarch's bandage is finally removed and the wound allowed to fill with aseptic blood.

I have in no case used any silver wires or drainage tubes both of which not only are superfluous, but necessitate the disturbance of the dressing and thereby may interfere with the healing process.

The first dressing I allow to stay on undisturbed for four to six weeks, according to the severity of the fracture, and, when then removed, I have in every case found a perfectly healed wound without a trace of pus. If the fracture is not then perfectly consolidated I reapply the plaster dressing.

I have during the last three years treated eleven cases of compound fractures of tibia and fibula in this way, most of which were very severe. One died of delirium tremens on the sixth day, but the wound was found perfectly aseptic. One was amputated on the third day on account of gangrene, but recovered, and nine recovered without any complications, such as necrosis, osteomyelitis, suppurations, etc., the wound in every case healing without a trace of pus.

I could with the greatest ease double or triple this little statistic if I would add compound fractures of other long bones and acute resections of joints on account of injuries. The result has in every case been the same—a perfectly aseptic course with a minimum of discomfort to the patient.

Is it not then about time to re-write the chapter on the treatment of compound fractures? I add a little statistic of eleven cases, giving in each case the age, cause, condition on admission and result. It is valuable particularly in showing the uniformity of results in the most different degrees of lesion and in different ages.

I have treated successfully in this way fractures on account of which I formerly without hesitation should have amputated, and I have very greatly modified my ideas of what is an indication for primary amputation. Let me, as an example, mention more fully case No. 11, in which I had the opportunity of examining the wound on the sixth day, the patient then dying of delirium tremens.

P. F., age twenty-one, was brought on November 30, 1891, to the Sisters of Charity Hospital with the following history: eighteen hours previously, while blasting in the Niagara tunnel, a large rock weighing several tons fell, striking him on the right leg in the lower third and producing a compound and comminuted fracture of both tibia and fibula and extensive lacerations of the soft parts. On examination at the hospital two large lacerated wounds were seen, one on the anterior surface, through which bone protruded, and one behind, extending well up on the calf. Both wounds were filled with numerous particles of stone, some as large as beans, and earth. Under ether-narcosis the wounds were freely enlarged and a third incision made over the fibula. Ten large splinters were removed, leaving a gap about two inches long between the ends of the bones.

The bone-ends were thereafter protruded through the wounds and sawed off transversely. At the point of fracture the bellies of all the muscles except peroneus longus, tibialis anticus and soleus were found torn across and pulpified for several inches. The crushed parts were removed with scissors, also all lacerated subcutaneous tissues and parts of the skin.

The posterior tibial artery was found ruptured and was doubly ligated. The foot was then held in place by the skin, the three muscles mentioned and the anterior tibial artery. The condition of the nerves was not ascertained. The wound was thereafter thoroughly irrigated, the incisions sutured with cat-gut in the way mentioned previously, the foot pushed upwards to approximate the bone-ends and held carefully in place while antiseptic dressing and a plaster of Paris bandage were applied. By measurement there was then fully two inches shortening. Moderate surgical fever followed, but the toes were warm and the patient comfortable till December 4th, when he was attacked by delirium tremens, to which he succumbed on December 6th.

The dressings were found perfectly sweet, without a trace of pus, and the wounds in the skin entirely agglutinated or healed. A blood clot was found organized around the bone-ends and between the severed muscles, and the whole condition gave every evidence that the final result would have been favorable if he had not died of delirium.

Case No.	Entered	Name	Age	Occupation	Condition and Cause	Result
1.	Nov. 8, 1888.	John Meyer.	65	Tramp.	Struck by railroad train. Lacerated wound of middle-third of leg, protruding bone-ends, oblique fracture with several loose fragments. Wound full of dirt and coal dust. Soft tissues badly lacerated.	No rise of temperature. Feb. 15, 1889, dressing changed. They were dry and no pus. Wound healed. Some looseness of fracture, why plaster dressing was reapplied. April 15, 1889, discharged cured.
2.	Jan. 10, 1889.	Timothy Cronin.	28	Printer.	Slipped on icy street and sustained compound fracture of both bones of right leg at junction of middle and lower third. Fracture oblique and bones protruding on anterior surface. Soft tissue badly crushed and lacerated.	Jan. 11, 1889, toes cold, bandage loosened Jan. 13th no return of circulation, gangrene. Amputation below knee. Made a good recovery.
3.	Oct. 9, 1890.	E. Clifford.	24	Carpenter.	Fell 15 feet from a ladder, producing compound fracture of both bones of left leg in lower third. Upper fragment protruding ¾ of an inch, wound full of dirt, soft tissue and muscular tissue badly lacerated.	Temperature on second day 101, Third day normal. Discharged December 5th, no deformity.
4.	Mar. 20, 1890.	Pat Kelly.	24	Carpenter.	Fell from scaffold, compound fracture near ankle joint. Several pieces of bone remained.	Discharged April 27th, 1891, recovered.
5.	Oct. 20, 1890.	John Getticker.	45	Huckster.	Was thrown from his wagon, fracturing both legs. Simple fracture of left leg, compound fracture of right leg in middle third. Fracture oblique, punctured wound on inner aspect of leg.	No rise of temperature. Discharged April 27th. Recovered.
6.	Feb. 28, 1890.	C. Mayor.	24	Unknown.	Fell on icy sidewalk. Punctured wound on anterior surface of left leg, oblique fracture.	No rise of temperature. May 7th wound healed, but fracture still loose. July 25th discharged recoverd.

Case No.	Entered	Name	Age	Occupation	Condition and Cause	Result
7.	Sept. 18, 1891.	S. Eastman.	30	Brakeman	Struck by engine, compound transverse fracture of tibia and fibula in middle third of left leg. Bones overlapping fully an inch. Punctured wound on inner surface of large incision was made in order to reduce the fracture, it being impossible to do so by extension alone. A great deal of crushed tissue and pulpified muscle was cut away Sharp edges of bone cut off	Temperature on second day 100, thereafter normal. October 24th wound healed without pus, fracture still loose. November 26th, still some looseness. The callous severely manipulated and plaster re-applied.
8.	Sept. 30, 1891.	Fred Ullman.	9	Schoolboy.	Fell under cars. Right leg crushed to a pulp in middle third, in left leg a badly compounded fracture between middle and lower third. Right leg amputated below knee joint. On left leg soft parts badly crushed, punctured wound on inner surface, through which upper fragmen protruded.	No rise of temperature. Discharged recovered November 18th.
9.	Nov. 6, 1891.	James Thomas.	40	Miner. (Colored.)	Struck in the Niagara tunnel by a large rock on left leg on day before. Compound fracture of tibia and fibula in the middle, fracture oblique, with ends of lower fragmina protruding through the skin.	No rise of temperature. December 20th wound healed, but some looseness of fracture. Plaster dressing re-applied. Is still in hospital.
10.	Nov. 10, 1891.	Mrs. Whistling	47	Housewife.	Thrown from a wagon [illegible]8 hours previously and received a compound fracture between middle and lower third of leg. No splint on when received. Large ragged wound over anterior and inner surface, through which the lower fragmen protruded for an inch. The anterior tibial muscle was caught between the bone-ends. Behind the upper fragmen, which was made to protrude, a large bone fragment, one inch long, was removed	No rise of temperature. Discharged to her home December 26th. Still some looseness at that time, why plaster cast was re-applied.
11.	Nov. 30, 1891.	Pat Flaherty.	21	Miner.	Injured at Niagara tunnel by blasting, on November 28th, producing comminuted and compound fracture of the tibia and fibula and diffuse laceration of skin, subcutaneous tissue, muscles and rupture of posterior tibial artery. Wound filled with dirt and particles of stone Ten large splinters removed, leaving a gap of two inches between the bones. The bellies of all the muscles except tibialis ant., peroneus longus, and soleus pulpified for several inches, and removed art. tibialis post. doubly ligated.	Died on 6th day of delirium tremens. All wounds found agelutinated or healed; a large organized blood clot was found between the bones and muscles. Not a trace of pus.